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U.S. FOREST SERVICE
RESEARCH PAPER LS-12
JULY 1964

The Identification of Primary Red Pine Cone Insects

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U. S. DEPARTMENT OF AGRICULTURE

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Introduction

Red pine (*Pinus resinosa* Ait.) is one of the most important species used for reforestation in the Lake States. Because of the high cost and lack of control over genetic quality of commercially collected seed, the National Forest Administration has established seed-production areas in natural stands of trees with desirable lumber-producing characteristics. Since the objective is maximum production of high-quality seed, foresters are concerned with any agent that hinders this objective. One of the most destructive agents of cones and seeds is insects, despite the fact that damage is confined to the second year of cone development (fig. 1).

This guide will familiarize the forester or nurseryman in the Lake States with the damage caused by insects to red pine cones, and enable him to recognize the mature larvae of the various species and understand their relative importance.

Two separate keys are included. The first is based on damage to the mature cones. The second is based on mature larval characteristics, since it is possible that larvae of at least four species might still be in the cones at harvest time.

The keys are based on earlier work in Canada by Lyons[1] and on the author's experience with seed and cone insects in the Lake States. The diagnostic characters in the keys are primarily those used by Lyons because they are visible to the naked eye or with a hand lens. Also included is a chart (see fig. 15 at end of report) which shows when developing larvae of the various species may be found working in the cones.

There are other species of insects that inhabit red pine cones besides those mentioned in the keys. They are secondary species that do not create their own diagnostic damage symptoms and are of little importance. Those interested in more specific information on primary and secondary species are referred to Lyon's work.

The following definitions will aid readers unfamiliar with some of the terms used in the keys:

NOTE: The author is an Entomologist on the Station's Seed, Cone, Aspen, and Shelterbelt Insect Project. He is located at the Station's Headquarters building, which is maintained on the St. Paul Campus by the Forest Service, U.S. Department of Agriculture, in cooperation with the University of Minnesota.

[1] *Lyons, L. A. Insects affecting seed production in red pine. I. Conophthorus resinosae Hopk. (Coleoptera: Scolytidae). Canad. Ent. 88: 599-608, 1956. II. Dioryctria spp. (Lepidoptera: Phycitidae). Canad. Ent. 89: 70-79, 1957. III Eucosma monitorana, Laspeyresia toreuta Grt. (Lepidoptera: Olethreutidae); Rubsaamenia sp. (Diptera: Cecidomyiidae); and other insects. Canad. Ent. 89: 150-164, 1957. IV. Recognition and extent of damage to cones. Canad. Ent. 89: 264-271. 1957.*

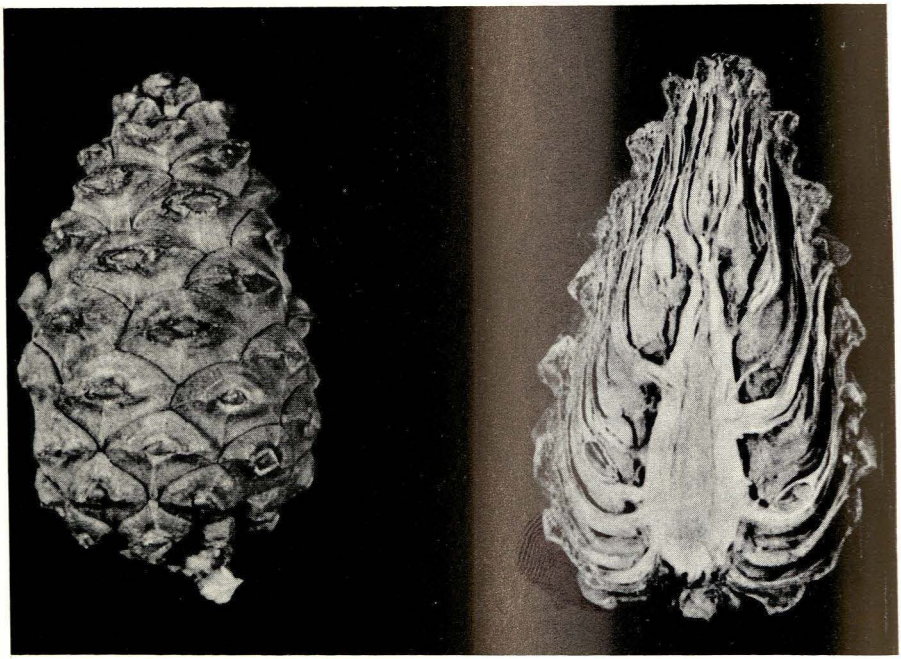

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FIGURE 1. — A mature undamaged red pine cone.

Frass. — Fecal material.
Sub-dorsal. — Just below the center line of the back or top of the insect.
Seta. — A hairlike bristle.
Anal plate. — A hardened, shieldlike patch on the posterior end of the larva.
Thoracic segment. — One of the three body segments, immediately posterior to the head, which bear the segmented legs.
Sclerotized. — Hardened and usually pigmented.
Dorso-ventrally. — From top to bottom.

A Key to Primary Red Pine Cone Insects By Mature Cone Damage Characteristics

1. Cone with one or more holes in exterior 2
1. Cone free of holes in exterior 5
    2. Webbing and coarse fecal pellets attached to exterior of cone 3
    2. Exterior of cone free of debris 4
3. A single hole, approximately 1/16 to 3/32 inch in diameter, in side of cone near base; large cavity deep within cone containing some dried resin, fecal pellets, and webbing; scales on same side of cone as hole usually withered (fig. 2) .....*Dioryctria disclusa* Heinrich
3. One to several ragged holes in side of cone; extensive tunneling usually free of debris just beneath cone exterior; some internal webbing (fig. 3) ..*Dioryctria abietella* (D. and S.)[3]
    4. Groove at base of cone leading from hole in axis to outer margin of cone; round emergence holes often present in side of cone; axis mined longitudinally; seeds and scales destroyed; cavities in cone contain fine, granular frass; cone small and dead (fig. 4) .....The red pine cone beetle, *Conophthorus resinosae* Hopk.
    4. Numerous tiny holes in cone exterior or one or more larger oblong holes between scales in side of cone; extensive tunneling in seeds and scale tissue packed with a cementlike mixture of resin and frass; no webbing; longitudinal groove in cone axis; cone almost always dead (fig. 5) .....*Eucosma monitorana* Heinrich
5. Exterior of cone normal; limited tunneling in seeds and cone axis; tunnels empty but tightly packed debris in mined seeds (fig. 6) .....*Laspeyresia toreuta* Grote
5. Some cone scales dried and shrivelled; copious amounts of dried resin between shrivelled scales; no tunneling or debris present (fig. 7) .....*Rubsaamenia* sp.

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[2] *Only one species, the red pine cone beetle, has an accepted common name.*

[3] *Or Dioryctria abietivorella (Grote) depending on authority. See Munroe, Eugene. Canadian species of Dioryctria Zeller (Lepidoptera: Pyralidae). Canad. Ent. 91: 65-72, 1959.*

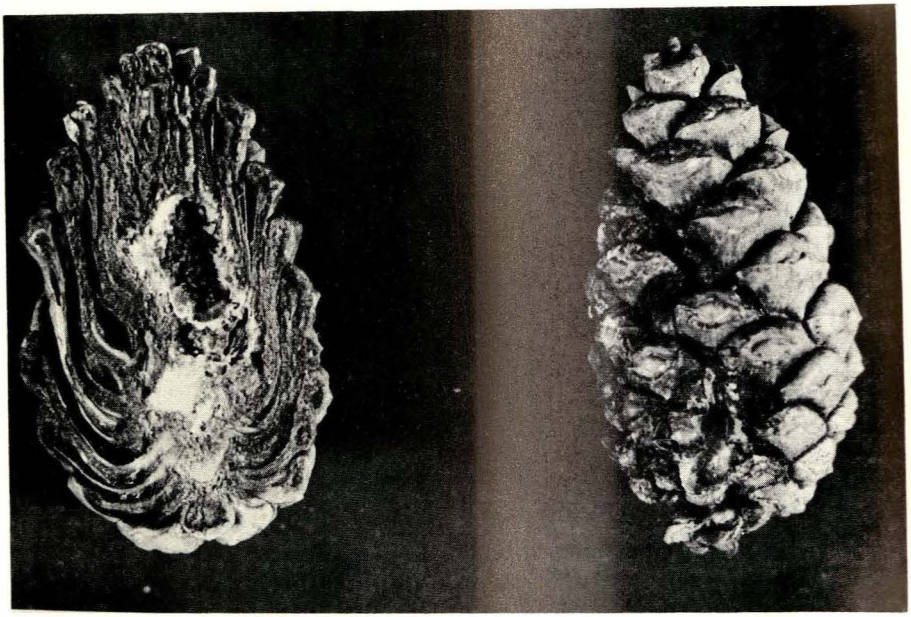

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FIGURE 2. — Cone infested by *Dioryctria disclusa*.

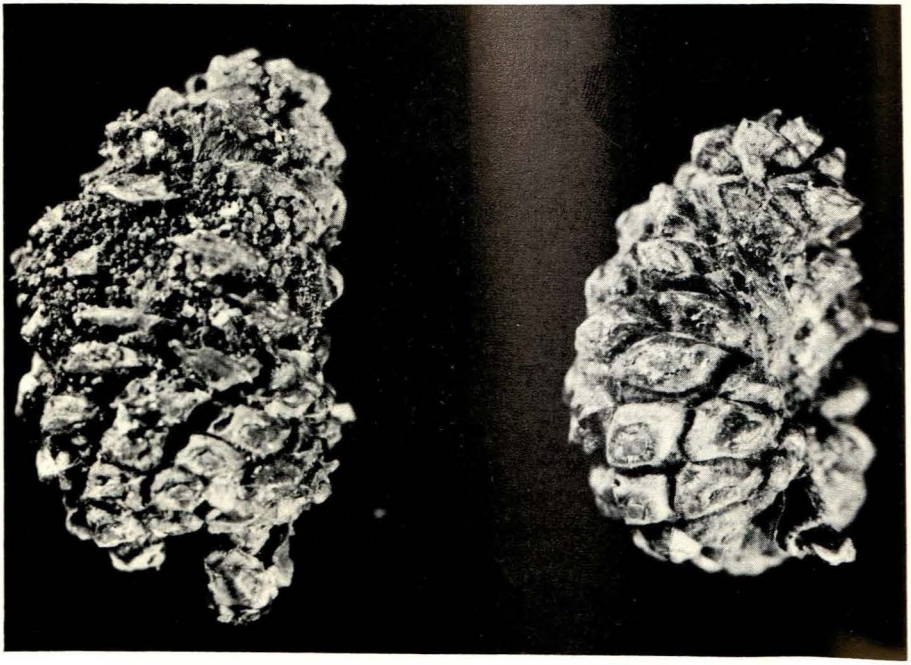

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FIGURE 3. — Cone infested by *Dioryctria abietella*.

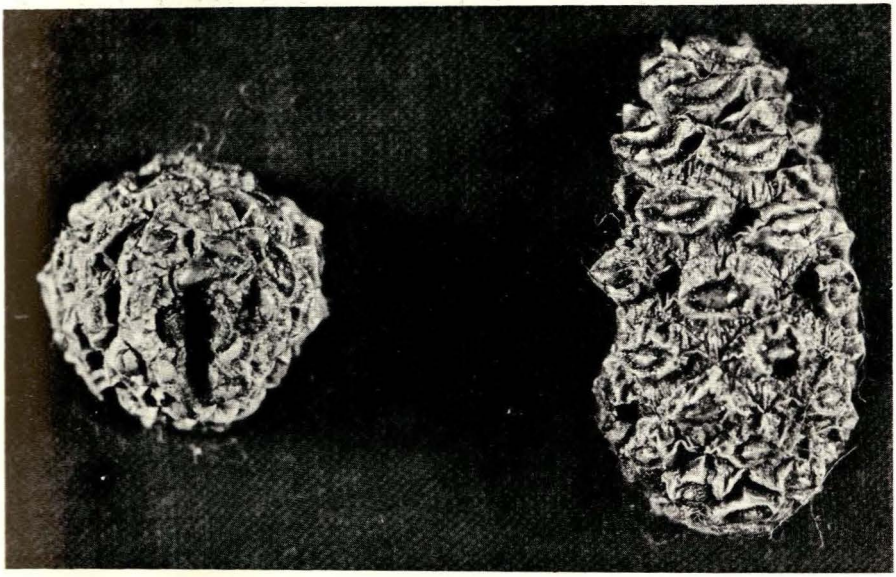

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FIGURE 4. — Cone infested by *Conophthorus resinosae*.

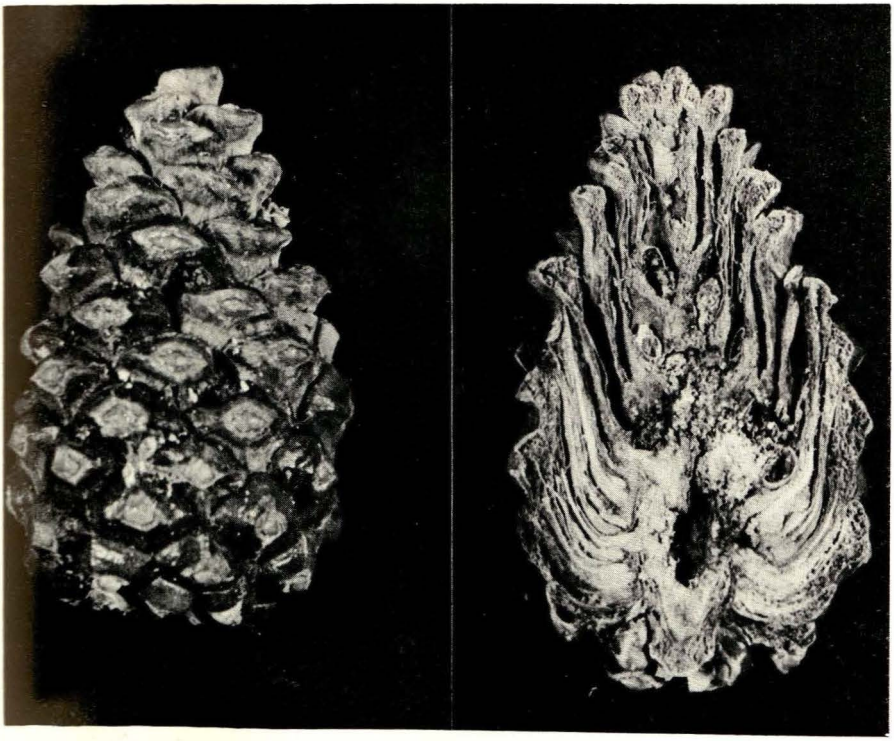

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FIGURE 5. — Cone infested by *Eucosma monitorana*.

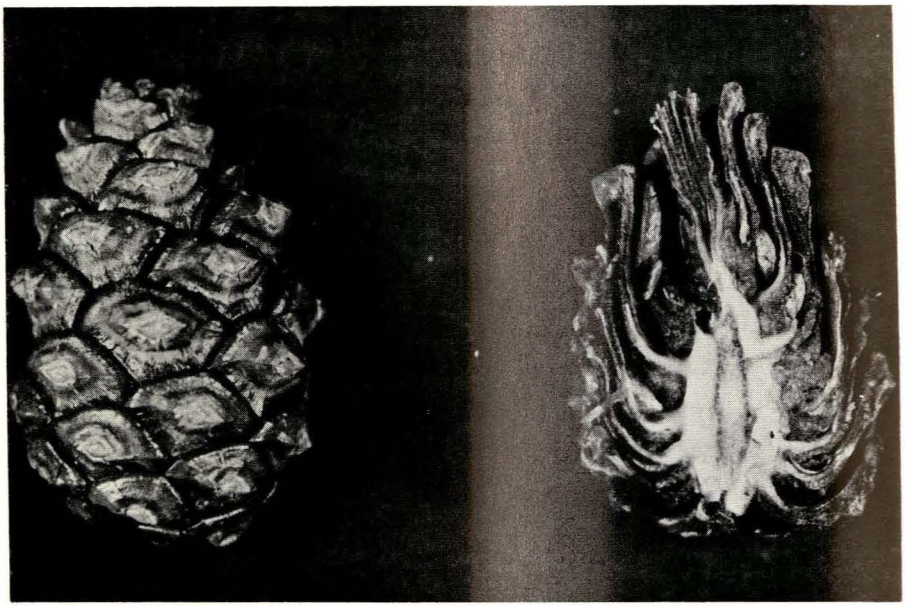

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FIGURE 6. — Cone infested by *Laspeyresia toreuta.*

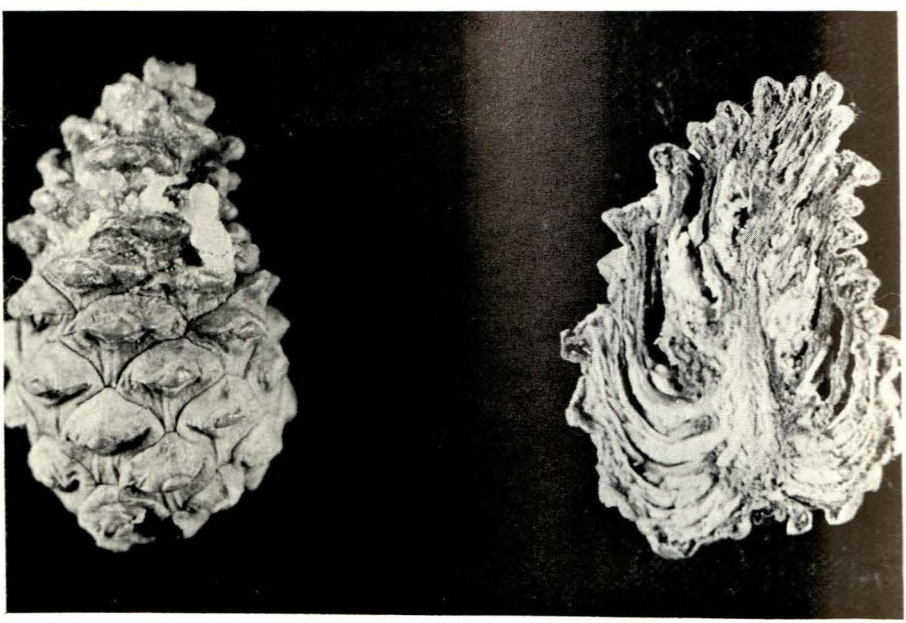

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FIGURE 7. — Cone infested by *Rubsaamenia* sp.

A Key to the Mature Larvae Of Primary Red Pine Cone Insects

1. Legs present; mature larvae usually occurring singly in a cone 2

1. Legs absent; several to many mature larvae per cone 5

2. Body longer than ½ inch; long sub-dorsal seta on second thoracic segment arising from a prominent sclerotized ring (fig. 8); body color variable but never white or near-white 3

2. One-half inch or less in length; head capsule brown; body color uniformly gray-white or creamy-white 4

3. Darkened lateral margins of anal plate (fig. 9); ⅝ to 1 inch in total length; body color dark green to reddish-purple ..... *Dioryctria abietella*

3. Uniformly pigmented anal plate (fig. 10); approximately ⅝ inch in total length; body color olive-green to purple-brown ..... *Dioryctria disclusa*

4. A dark spot within area bounded by simple eyes and another at rear of head capsule (fig. 11); setae on body easily visible with a hand lens; ½ inch in total length; body stout, gray-white ..... *Eucosma monitorana*

4. Thorax wider than partially retractable head (fig. 12); body devoid of easily visible setae; slightly less than ½ inch in total length; body slender, creamy white ..... *Laspeyresia toreuta*

5. Anterior end pointed; anal end with a pair of upward curved hooks (fig. 13); body flattened dorsoventrally; approximately 3/32 inch in total length; body reddish-orange and semi-transparent; usually many larvae per cone ..... *Rubsaamenia* sp.

5. Sclerotized light brown head capsule; body C-shaped and grublike (fig. 14); approximately 3/16 inch or less in total length; body color creamy-white; usually several larvae per cone ..... The red pine cone beetle, *Conophthorus resinosae*

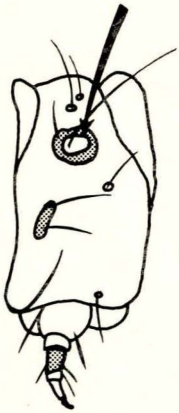

FIGURE 8
DIORYCTRIA SPP.; SECOND THORACIC SEGMENT; SIDE VIEW.

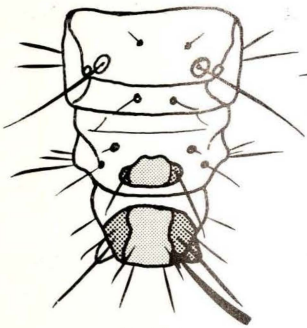

FIGURE 9
DIORYCTRIA ABIETELLA; ANAL SEGMENTS; DORSAL VIEW.

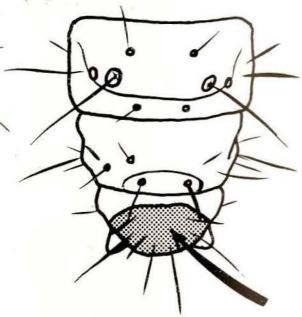

FIGURE 10
DIORYCTRIA DISCLUSA; ANAL SEGMENTS; DORSAL VIEW.

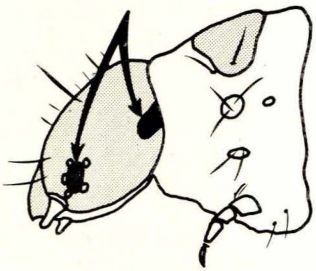

FIGURE 11
EUCOSMA MONITORANA; HEAD CAPSULE AND FIRST THORACIC SEGMENT; SIDE VIEW.

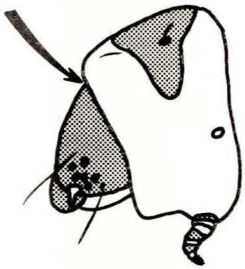

FIGURE 12
LASPEYRESIA TOREUTA; HEAD CAPSULE AND FIRST THORACIC SEGMENT; SIDE VIEW.

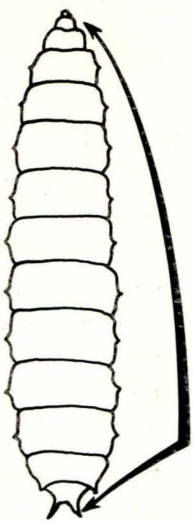

FIGURE 13
RUBSAAMENIA SP.; DORSAL VIEW.

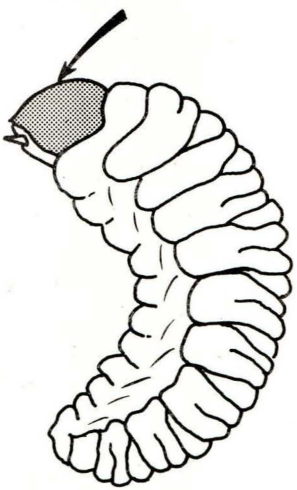

FIGURE 14
CONOPHTHORUS RESINOSAE; SIDE VIEW.

FIGURES 8 through 14. — Illustrating mature larval characteristics of the most important red pine cone insects.

Relative Importance of Insects

The insects discussed below are listed in order of the importance of their impact to individual cones; this order is constant. But when considering overall impact to a seed crop, the picture changes drastically and is variable from stand to stand and year to year.

Conophthorus resinosae. — Mining in the cone axis by the adult beetles for feeding or oviposition kills the cone, thus terminating development of the seed. When the population is extremely high, a portion is sometimes forced to breed in shoots, which destroys any developing conelets on the mined shoots. This species has been found in abundance throughout the Lake States.

Eucosma monitorana. — Individual larvae require two cones to complete development. Attack almost invariably kills both cones and terminates development of any seed that have not already been consumed. This species occurred infrequently in cone samples but has been reported as abundant in some stands in southern Wisconsin.

Dioryctria disclusa. — Early larval feeding is confined to male flowers until the time of pollen dissemination. However, individual mature larvae usually attack two cones before pupating. Since the larvae feed deep within the cone, some seeds are consumed. In addition, the cone axis is sometimes severed, resulting in death of the cone and remaining seed. This species occurred in moderate numbers in cone samples.

Dioryctria abietella. — Feeding by young larvae is confined to cones previously infested by other species. Individual mature larvae usually attack more than one cone, but feeding damage occurs near the cone exterior and some seed are released. This species occurred in moderate numbers in cone samples.

Rubsaamenia sp. — Larval feeding on surfaces between the cone scales causes a copious flow of resin and withering of the affected scales. These scales do not separate during normal cone opening, and their seeds are not released. This species occurred frequently in cone samples, and is often associated with damage by other species.

Laspeyresia toreuta. — Larval feeding is limited primarily to seed, but some escape attack. Since the cone scales are not affected, the cone opens normally and undamaged seeds are released. This species occurred infrequently in cone samples.

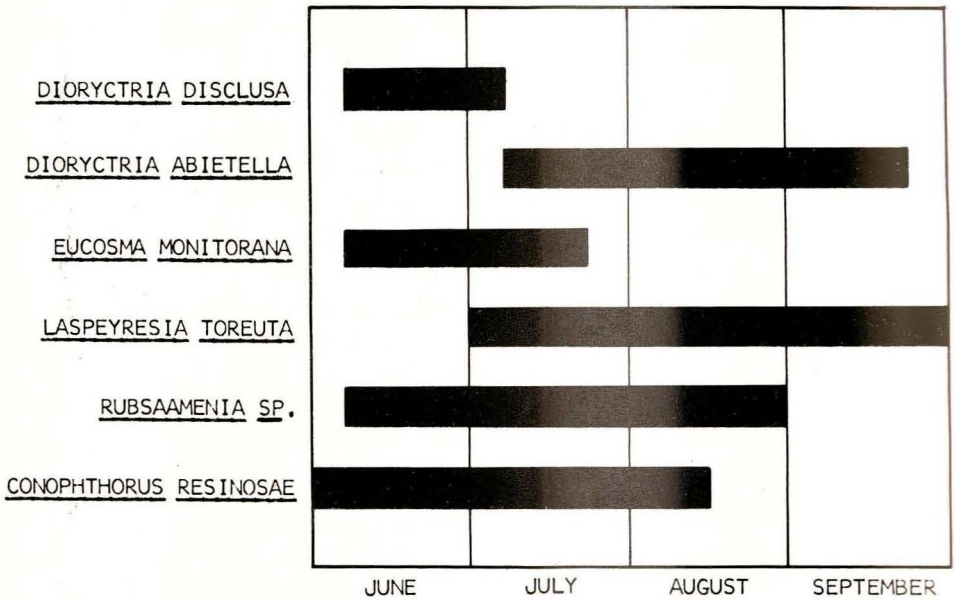

FIGURE 15. — Periods of larval occurrence in ripening red pine cones in the Lake States.

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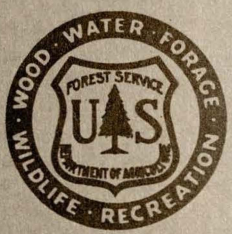
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